

42-079-00014

UGI Development Company

February 6, 2008

390 Route 11
P.O. Box 224
Hunlock Creek, PA 18621-0224
(570) 830-1269

CERTIFIED MAIL NO. 7005 1820 0002 8263 5706

Mrs. Rene McLaughlin
3 AP 2
United States Environmental Protection Agency
Region 3
1650 Arch Street
Philadelphia, PA 19103-2025

RECEIVED
FEB 21 2008
Air Protection Division (3AP12)

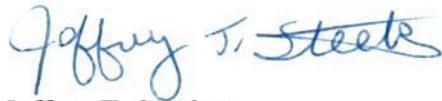
RE: UGI DEVELOPMENT COMPANY
HUNLOCK POWER STATION
RATA NOTIFICATION - BOILER NO. 6

Dear Mrs. McLaughlin,

This letter is to inform you that UGI Development Company is tentatively scheduled to perform the Annual RATA Testing on Hunlock Power Station's Unit No. 6 (Coal Unit) during the week of April 28, 2008.

If you should have any questions, please call me at (570) 830-1267.

Sincerely,



Jeffrey T. Steeber
Staff Engineer
Hunlock Power Station

RECEIVED
FEB 21 2008
Air Protection Division (3AP12)

JTS:chet



AIR QUALITY TESTING SERVICES

UGI DEVELOPMENT COMPANY
HUNLOCK STATION
UNIT 6

CEMS TEST PROTOCOL

Catalyst Air Management, Inc.
(Lab Registration No. 6-3118)
Project Number 124-036

JANUARY 17, 2008



**UGI DEVELOPMENT COMPANY
HUNLOCK STATION
UNIT 6**

CEMS RATA PROTOCOL

**CATALYST AIR MANAGEMENT, INC.
(Lab Registration No. 6-3118)
PROJECT NUMBER 124-036**

JANUARY 17, 2008

Prepared for
Mr. Jeff Steeber
UGI Development Company
Hunlock Station
US Route 11, PO Box 224
Hunlock Creek, PA 18621



STATEMENT OF VALIDITY

UGI Development Company – Hunlock Station
Catalyst Project 124-036
January 16, 2008

To the best of our knowledge, the applicable state and federal regulations, operating permits, or plan approvals applicable to each source and control device being tested have been reviewed and all the testing requirements have been incorporated into this test protocol.

A handwritten signature in black ink, appearing to read 'Michael J. Taylor'.

Michael J. Taylor
President – Catalyst Air Management
2505 Byington-Solway Road
Knoxville, TN 37931
(865) 531-0075

A handwritten signature in black ink, appearing to read 'Jeff Steeber'.

Jeff Steeber
UGI Development Company
Hunlock Station
US Route 11, PO Box 224
Hunlock Creek, PA 18621
(570) 830-1267

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STATEMENT OF VALIDITY

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PROJECT FACT SHEET

NAME OF SOURCE OWNER: UGI Development Company

SOURCE IDENTIFICATION: Hunlock Station Unit 6

LOCATION OF SOURCE: Route 11, PO Box 224
Hunlock Creek, PA 18621

TYPE OF OPERATION: Coal Fired Utility Steam Generator

TYPES OF TESTS PERFORMED: Sample and Velocity Traverse-EPA Method 1
Volumetric Flow Rate-EPA Method 2F/H
Oxygen/Carbon Dioxide-EPA Method 3A
Moisture Content-EPA Method 4
Sulfur Dioxide-EPA Method 6C
Nitrogen Oxide-EPA Method 7E
Opacity-EPA Method 9

CEMS DESCRIPTION: Air Monitor Mastron Flow - B26354
Thermo Environmental SO₂ - 43C-69110-362
Thermo Environmental NO_x - 42C-69062-362
Thermo Environmental CO₂ - CHL-68209-359
Air Monitor RAC Opacity - 0045-65, 0018-65
VIM Technologies DAHS - 14787WIN

TEST COMPANY: Catalyst Air Management, Inc.
2505 Byington-Solway Road
Knoxville, TN

SITE SUPERVISOR: Jeff Ferguson - Principal

TEST PERSONNEL: Scott Williams - Lead Technician
Mark Williams - Technician

PROPOSED TEST DATES: Week of April 28, 2008

OWNERS REPRESENTATIVE: Jeff Steeber

TEST OBSERVER:

1.0 Introduction

Catalyst Air Management, Inc. (Catalyst) has been contracted by UGI Development Company (UGI) to perform the Continuous Monitoring System (CEMS) Relative Accuracy Test Audit (RATA) for Unit 6 at the Hunlock Station in Hunlock Creek, PA.

The sampling program is scheduled for the week of April 28, 2008. The Catalyst contact is Mike Taylor (865) 531-0075 or Jeff Ferguson (610) 913-7600. Mr. Jeff Steeber of UGI will coordinate plant and CEMS operation during the testing.

2.0 Description of Process

The Hunlock Station, Unit 6, is a pulverized coal fired boiler. No.2 fuel oil is used for ignition and flame stabilization. The boiler is rated at 400,000 lbs/hr of steam at 1350 psig and 955 °F. It is a Foster Wheeler drum type, wet bottom, arch fired, balanced draft unit with a nominal heat input of 562 mmBtu/hr. The steam is supplied to a turbine/generator rated at approximately 50 MW. The flue gas is passed through a primary and secondary precipitator for particulate control. A process flow diagram is included in the figures section.

3.0 Description of Sampling Locations

The Unit 6 stack is 40.5 feet high, with an inside diameter of 9.5 feet. The sampling location is approximately 14.5 upstream from the stack exit and 27 feet downstream of the inlet duct. A schematic of the sampling location is included in the figures section.

4.0 Description of CEMS

The Unit 6 CEMS is a dilution extraction system that measures SO₂, NO_x and CO₂ concentrations at the sampling location. The CEMS analyzers include a Thermo Environmental Model 43H SO₂ analyzer, Thermo Environmental Model 42D NO_x analyzer, Thermo Environmental Model 41CHL CO₂ analyzer and a Air Monitor Mastron Electron Flow monitor. The recording and reporting requirements are performed by a computerized data acquisition and handing system.

Unit 6 CEMS

- (1) Thermo Environmental SO₂ - 43C - Serial No. - 43C-69110-362
- (1) Thermo Environmental NO_x - 42D - Serial No. - 42D-69062-362
- (1) Thermo Environmental CO₂ - 41CHL - Serial No. - 41CHL-68209-359
- (1) Air Monitor Mastron Electronic Flow- Serial No. B26354
- VIM Technologies Data Acquisition and Handling System – Serial No.14787WIN

The analyzers measure on a wet basis. The data acquisition and handling system utilizes a Fc factor of 1910 scf/mmBtu to calculate NOx emissions in lbs/mmBtu.

5.0 Sampling Program Procedures

The following test methods were utilized during the test program:

EPA Method 1	Sample and Velocity Traverse for Stationary Sources
EPA Method 2F	Determination of Stack Gas Velocity and Volumetric Flow Rate with Three-dimensional Probes
EPA Method 2H	Determination of Stack Gas Velocity and Volumetric Flow Rate Taking into Account Velocity Decay Near the Stack Wall
EPA Method 3A	Gas Analysis for CO ₂ , O ₂ , Excess Air and Dry Molecular Weight (Instrumental Analyzer Method)
EPA Method 4	Determination of Moisture Content in Stack Gas
EPA Method 6C	Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Method)
EPA Method 7E	Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Method)
EPA Method 9	Visual Determination of the Opacity of Emissions from Stationary Sources

5.1 NO_x, SO₂ and CO₂ – EPA Methods 3A, 6C and 7E

A sample is continuously extracted and introduced into a Thermo Environmental Model 10, Chemiluminescent NO_x analyzer, a Western Research Model 721, SO₂ analyzer and Servomex 1400 O₂/CO₂ analyzer for determination of gas concentrations. The sample is extracted through a heated stainless steel probe, heated sample line and sample conditioner to dry the sample before it enters the analyzers. A sample flow control system is used to control the flow into the analyzers. The analyzers are calibrated prior to starting the testing with EPA Protocol 1, calibration gases. A system bias check is performed before each run by introducing the zero and upscale gas at the back end of the sample probe. The system bias check is repeated at the end of each test run to determine the analyzer zero and calibration drift. Nine (9) to twelve (12) test runs will be conducted with each being twenty-one (21) minutes in duration.

The NO_x analyzer spans are expected to be approximately 0-250 ppm. The SO₂ analyzer span is expected to be approximately 0-1000. The O₂/CO₂ analyzer spans will be approximately 0-25% and 0-20%, respectively. The calibration gases that will be utilized are zero, 40-60% and 80-100% of span. The high calibration gas will determine the span and be the bases for mid gas, as well as bias and drift calculations.

A stratification test will be performed to determine the number of sample points needed.

Reference Method Analyzers:

<u>Manufacturer</u>	<u>Model</u>	<u>Pollutant</u>	<u>Span</u>
TECO	10A	NOx	0-250 ppm
Western Research	721	SO ₂	0-1000 ppm
Servomex	1400B	CO ₂ /O ₂	0-20%/0-25%

5.2 Volumetric Flow Rate - EPA Method 2F/H

Traverse points and flow relative accuracy runs will be performed using EPA Methods 1, 2F, 2H, 3A and 4. The velocity and volumetric flow rate will be determined in accordance with procedures outlined in EPA Method 2F/H. A DAT prism 3-D probe is connected to a series of calibrated magnehelics and manometers to determine the yaw and pitch angles, static pressure and pitch coefficient of the flue gas at each traverse point. The temperature of the flue gas is also determined at each traverse point.

A minimum of nine (9) test runs will be performed at each load condition.

5.3 Moisture – EPA Method 4

The moisture content will be determined in accordance with procedures outlined in EPA Method 4. The flue gas sample is extracted from the gas stream and the moisture content is determined by measuring the increase in volume of the impingers. The sampling train consists of the following equipment connected in series:

Stainless steel heated sample probe

A modified Greenburg-Smith impinger containing 100 ml of H₂O

A Greenburg-Smith impinger containing 100 ml of H₂O

A modified Greenburg-Smith impinger, empty

A modified Greenburg-Smith impinger containing approximately 250g of silica gel

The sample volume is measured by passing it through a calibrated dry gas meter. After the run, the impinger contents are measured for increase in volume. The silica gel is returned to the original tared container and weighed to determine moisture gain.

A moisture determination will be performed with every pollutant test run and for every three (3) flow traverses.

5.4 F Factor Determination

Coal samples will be collected during the testing in order to determine the dry F factor used to calculate the emission rates in lb/mmBtu.

5.5 Opacity

The opacity monitor audit will be conducted by performing a minimum of nine (9) visible emissions evaluations. The visible emission evaluations will be 15 minutes in duration. Each of the evaluations will generate 15 - one minute averages that will be compared to the one minute averages generated by the CEMS during the same time period. A certified visible emission evaluator will conduct the audit.

All the procedures used for the RATA program were performed in accordance with the Code of Federal Regulations, Title 40, Part 60, Appendix A, and Appendix B, Performance Specifications 2, 3 and 6, Part 75 and the Source Testing Manual Rev 3.3.

6.0 Quality Assurance Procedures

The quality assurance procedures followed during the testing activities followed guidelines set forth by the previous mentioned methods and the EPA Quality Assurance Handbook for Source Sampling. The specific procedures for this test program are listed below.

6.1 Velocity/Volumetric Flow Rate

The 3-D probe will be visually inspected and calibrated to meet the design specifications of EPA Method 2F.

All legs of the probe will be leaked checked before and after each sample run.

The stack thermocouples will be calibrated prior to the testing and a post test check will be performed after the testing project.

The magnehelics will be leveled and zeroed before each sample run.

6.2 Moisture

The dry gas meter is fully calibrated annually using an EPA intermediate standard.

Post -test dry gas meter checks will be completed to verify the accuracy of the meter Yi.

Pre-test and post-test leak checks will be completed and were less than 0.02 cfm at the highest sampling vacuum.

6.3 Instrumental Methods

Analyzer calibrations, system bias check and drift checks will be completed before and after each sample run utilizing EPA Protocol calibration gases.

The NOx analyzer NO₂ to NO converter efficiency is determined in accordance with Section 16.2.2 of Method 7E.

The analyzer interference responses are determined in accordance with Section 8.2.7 of Method 7E and Section 16 of Method 6C.

6.4 Data and Calculations

Plant CEMS data and reference method data will be imported into EPA MDC software for error evaluation.

A manual calculation check will be performed on a single run for each parameter.

7.0 Unit Operational Data

UGI will be responsible for the operation of the units and CEMS. UGI personnel will provide documentation for operational conditions maintained during the testing. The CEMS data acquisition and handling system (DAHS) will provide emissions data to determine the system relative accuracy.

8.0 Test Report

The test report will be submitted that will provide the results of the test program and all the pertinent information pertaining to the individual tests. The report will include the following:

- Unit description
- Sampling location and test points
- Unit operating data and production data
- Test personnel
- Test results and discussion of the test program
- Raw test data
- Equipment calibration and test method QA
- Sample Calculations

ATTACHMENT 1

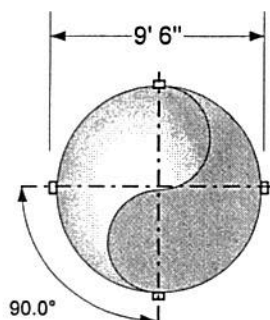
Figures

TRAVERSE POINTS (Typ 4 Ports)

FLOW

(Inches) from inside of stack.

1. 3.6"
2. 12.0"
3. 22.1"
4. 36.8"

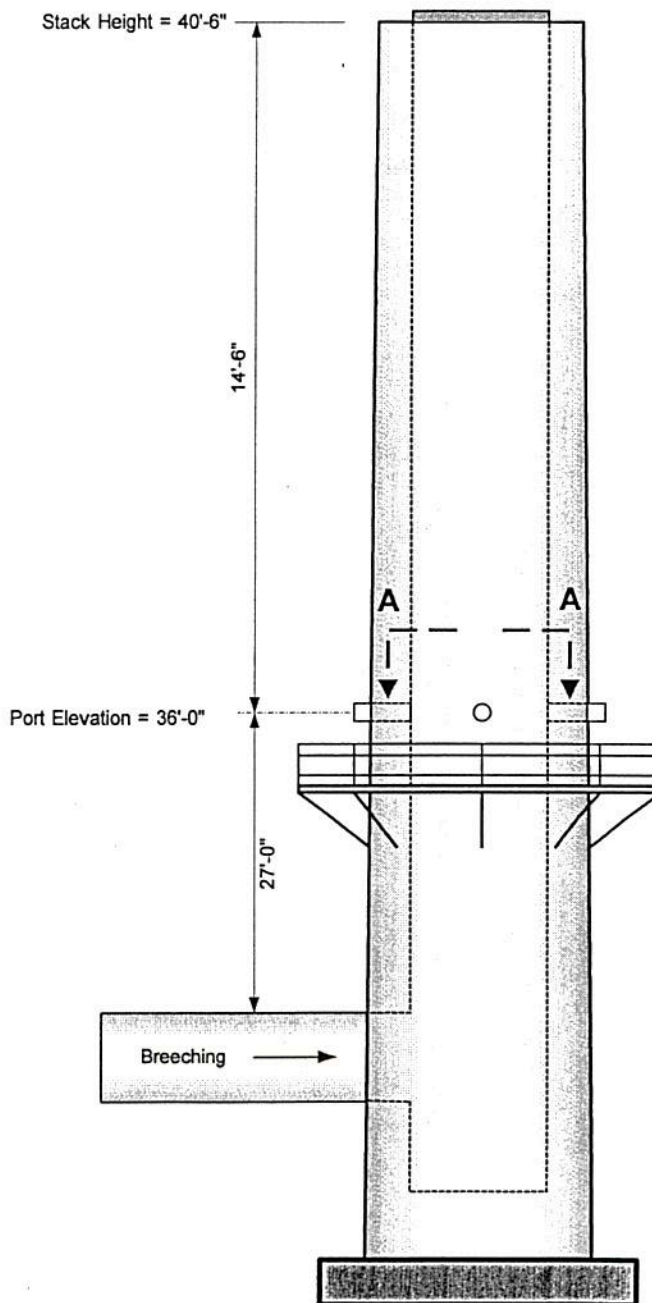


SECTION A - A

TRAVERSE POINTS

(inches) from inside of stack wall.

1. 19.0
2. 57.0
3. 95.0



TITLE

UGI DEVELOPMENT COMPANY - HUNLOCK STATION

DESCRIPTION

UNIT 6 TEST PORT CONFIGURATION

DATE

7/24/98

SCALE

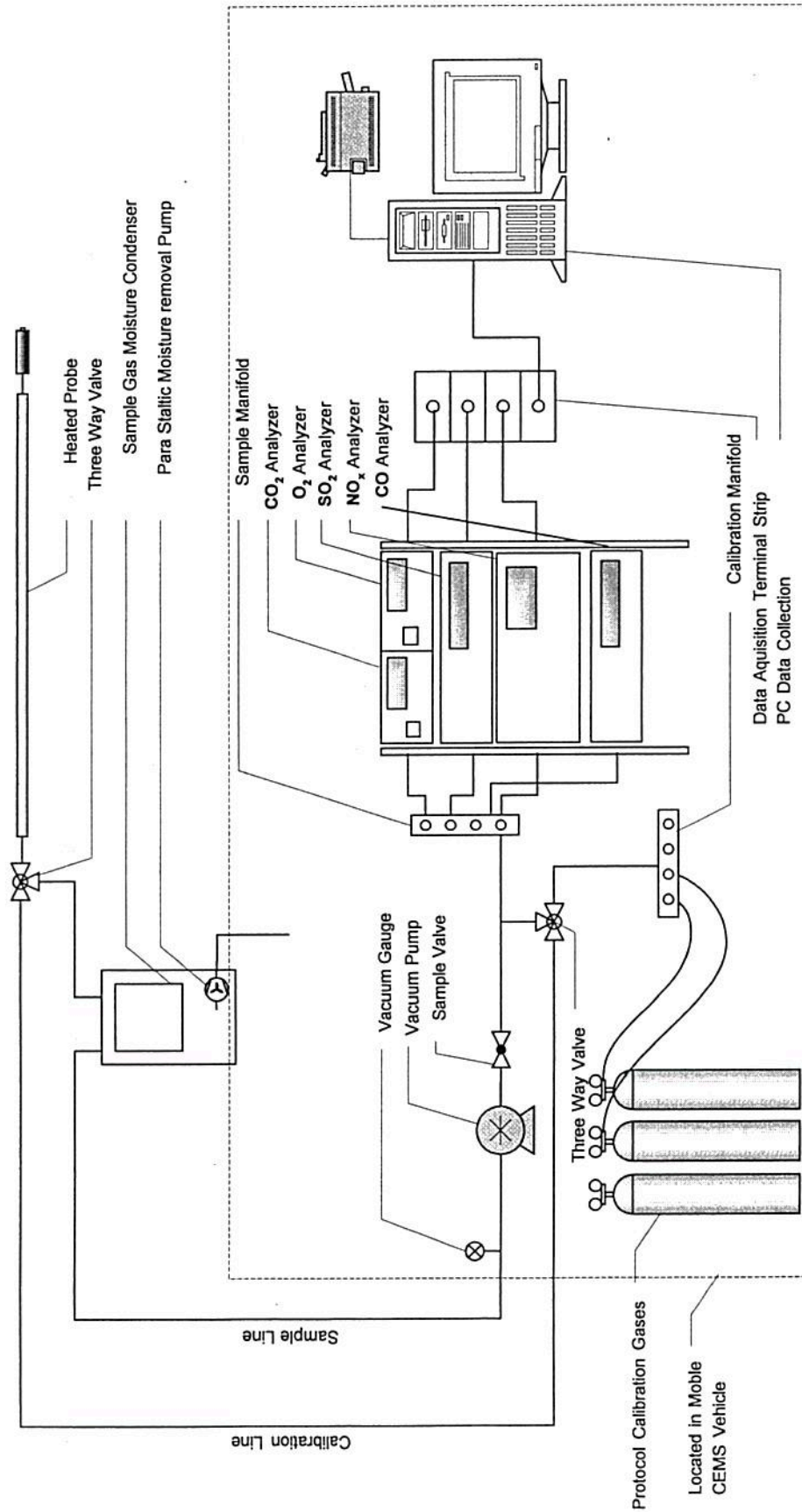
NONE

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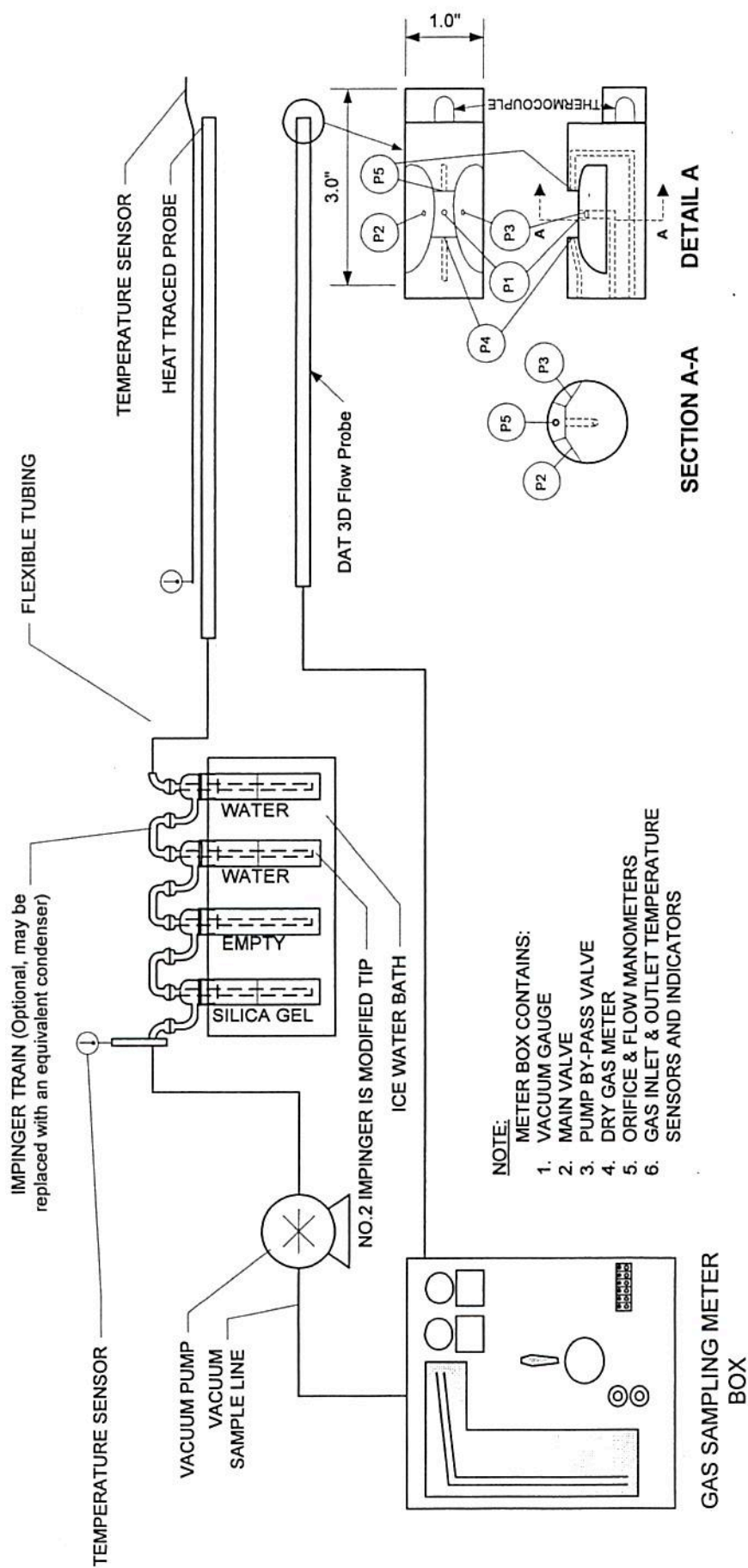
MJ TAYLOR

REVISED

5/18/07



TITLE		EPA INSTRUMENTAL SAMPLE TRAIN	
DESCRIPTION		DATE	
SAMPLE TRAIN SCHEMATIC		01-26-98	
SCALE	DRAWN BY	REVISED	
NONE	RF COBB		



TITLE

EPA METHOD 2F-4 SAMPLING TRAIN

DESCRIPTION

3-D FLOW & MOISTURE

DATE

01-26-98

SCALE

NONE

DRAWN BY

RF COBB

REVISED

9/8/2004

ATTACHMENT 2

Field Data Sheets

DATE: _____

RUN #:

Analyzer:

SO₂

Scale:

TIME:

Zero Gas:

Mid-Range:

High-Range:

Cylinder Value

Analyzer Calib.

System Calib.

Run 1 Start:

End:

System Calib.

Run 2 Start:

End:

System Calib.

Run 3 Start:

End:

System Calib.

Run 4 Start:

End:

System Calib.

Run 5 Start:

End:

System Calib.

Run 6 Start:

End:

System Calib.

Run 7 Start:

End:

System Calib.

Run 8 Start:

End:

System Calib.

Run 9 Start:

End:

System Calib.

Run 10 Start:

End:

System Calib.

Run 11 Start:

End:

System Calib.

Run 12 Start:

End:

IMPINGERS
SILICA GEL
TOTAL MOISTURE

INC. AIR QUALITY TESTING SERVICES
VISIBLE EMISSION OBSERVATION FORM

OBSERVATION DATE						START TIME	END TIME
	0	15	30	45	COMMENTS		
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
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16							
17							
18							
19							
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21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

COMPANY NAME _____

STREET ADDRESS _____

CITY _____ STATE _____ ZIP _____

PHONE (KEY CONTACT) _____ SOURCE I.D. NUMBER _____

PROCESS EQUIPMENT _____ OPERATING MODE _____

CONTROL EQUIPMENT _____ OPERATING MODE _____

DESCRIBE EMISSION POINT _____

HEIGHT ABOVE GROUND LEVEL _____ HEIGHT RELATIVE TO OBSERVER
Start _____ End _____

DISTANCE FROM OBSERVER _____ DIRECTION FROM OBSERVER
Start _____ End _____

DESCRIBE EMISSIONS
Start _____ End _____

EMISSION COLOR _____ IF WATER DROPLET PLUME
Start _____ End _____ Attached _____ Detached _____

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED
Start _____ End _____

DESCRIBE PLUME BACKGROUND
Start _____ End _____

BACKGROUND COLOR _____ SKY CONDITIONS
Start _____ End _____

WIND SPEED _____ WIND DIRECTION
Start _____ End _____

AMBIENT TEMP. _____ WET BULB TEMP _____ RH, percent _____
Start _____ End _____

Stack with Plume

Sun

Wind

SOURCE LAYOUT SKETCH

Draw North Arrow

OBSERVER'S NAME (PRINT) _____

OBSERVER'S SIGNATURE _____ DATE _____

ORGANIZATION _____

CERTIFIED BY _____ DATE _____

CONTINUED ON VEO FORM NUMBER _____

ATTACHMENT 3

Sample Calculations

SAMPLE EQUATIONS FOR CEMS RELATIVE ACCURACY TEST AUDITS

CALCULATIONS FOR FLUE GAS VOLUME AND MOISTURE

Time	Dry Gas Meter Ft ³	Pitot ΔP In. H ₂ O	Orifice ΔH In. H ₂ O	Dry Gas Temp. °F In Out	Flue Gas Static Pressure In. H ₂ O	Stack Temp °F
T	V _m	Δp	ΔH	TMI TMO	P _g	T _s

1. P_{bar} = Barometric Pressure (in. Hg)
2. TT = Net Sampling Time (minutes)
3. V_m = V_m Final - V_m Initial = Sample Gas Volume (Ft³)
4. T_m = Average Dry Gas Temperature at Meter (°F)

$$T_m = \frac{Avg.TMI + Avg.TMO}{2}$$

5. Δp = Velocity head of stack gas (in. H₂O)
6. ΔH = Average Orifice Pressure Drop (in. H₂O)
7. Volume of dry gas sampled at standard conditions^a (DSCF)

$$V_{m(std)} = \frac{(17.64)(V_m)(Y)\left(P_{bar} + \frac{\Delta H}{13.6}\right)}{(T_m + 460)}$$

8. V_{lc} = Total Water Collected = gm H₂O Silica gel + ml Imp. H₂O = ml
9. Volume of water vapor at standard conditions^b (SCF)

$$V_{w(std)} = 0.0471(V_{lc}) = SCF$$

10. Percent moisture in flue gas

$$\%M = \frac{100(V_{w(std)})}{V_{m(std)} + V_{w(std)}}$$

11. Mole fraction of water vapor in flue gas

$$B_{ws} = \frac{\%M}{100}$$

12. Molecular Weight of dry flue gas

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$$

13. Molecular weight of wet flue gas

$$M_s = M_d(1 - B_{ws}) + 18(B_{ws})$$

14. A = Cross-sectional area of stack (Ft²)

$$\frac{\pi r^2}{144}$$

15. P_s = Flue gas pressure (in, Hg)

$$P_s = P_{bar} + P_g$$

NOTE:
$$P_g(Hg) = \frac{P_g(in. H_2O)}{13.6}$$

16. T_s = Absolute stack temperature (°R)

$$T_s = 460 + t_s$$

17. Flue velocity at stack conditions (FT/SEC)

$$V_s = (K_p)(C_p) \left[(\sqrt{\Delta p})_{avg} \right] \sqrt{\frac{T_s(avg)}{P_s * M_s}}$$

C_p = pitot tube coefficient

K_p = pitot tube constant = 85.49ft/sec

18. Flue gas volumetric flow rate at standard conditions^b (SCFM)

$$Q_s = (V_s)(A) \left(\frac{528}{T_s(\text{avg.})} \right) \left(\frac{P_s}{29.92} \right) (60)$$

19. Flue gas volumetric flow rate at standard conditions^c (DSCFM)

$$Q_{sd} = (1 - B_{ws})(V_s)(A) \left(\frac{528}{T_s(\text{avg.})} \right) \left(\frac{P_s}{29.92} \right) (60)$$

20. Flue gas volumetric flow rate at stack conditions (ACFM)

$$Q_a = (V_s)(A)(60)$$

NOTES:

^aDry standard cubic feet at 68°F, 29.92 in. Hg

^bStandard conditions at 68°F, 29.92 in. Hg

^cDry standard cubic feet per minute at 68°F, 29.92 in. Hg

CALCULATIONS FOR 3-D PITOT TUBE VELOCITY

RESULTANT ANGLE R_i

$$R_i = \arccos [(\cosine Y_i) * (\cosine P_i)]$$

AXIAL VELOCITY

$$V_i = K_p * F_2 * [T_i (P_1 - P_2) / (P_a * M_s)]^{0.5} * (\cosine Y_i) * (\cosine P_i)$$

V_i	=	Velocity at point i, fps
K_p	=	Conversion factor 85.49
T_i	=	Absolute stack temperature at point i, °R
$P_1 - P_2$	=	Pressure differential from 3-D probe, in H ₂ O
P_a	=	Absolute stack pressure, in Hg
M_s	=	Molecular weight of stack gas, lb/lb-mole
F_2	=	3-D pitot coefficient, $[(P_t - P_s) / (P_1 - P_2)]$
$P_t - P_s$	=	Velocity pressure from standard type pitot, in H ₂ O
C_{ps}	=	Standard pitot tube coefficient

CALCULATION FOR GAS CONCENTRATION

GAS CONCENTRATION (C_{gas})

$$C_{gas} = (\bar{C} - C_0) \left(\frac{C_{ma}}{C_m - C_0} \right)$$

- C_{gas} = Effluent gas concentration, ppm
 \bar{C} = Average gas concentration indicated by gas analyzer, dry basis, ppm
 C_0 = Average of initial and final system calibration bias check responses for the zero gas, ppm
 C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, ppm
 C_{ma} = Actual concentration of the upscale calibration gas, ppm

GAS CONCENTRATION @ 15% O₂ ($C_{gas} @ 15\% O_2$)

$$C_{gas} @ 15\% O_2 = C_{gas} * ((20.9-15)/(20.9-\%O_2))$$

GAS CONCENTRATION @ 7% O₂ ($C_{gas} @ 7\% O_2$)

$$C_{gas} @ 7\% O_2 = C_{gas} * ((20.9-7)/(20.9-\%O_2))$$

GAS CONCENTRATION @ 3% O₂ ($C_{gas} @ 3\% O_2$)

$$C_{gas} @ 3\% O_2 = C_{gas} * ((20.9-3)/(20.9-\%O_2))$$

F-FACTOR DETERMINATION

THE WET F-FACTOR (F_w):

Includes all components of combustion

$$F_w = \frac{10^6 \text{ Btu} / \text{mmBtu} [5.57(\%H) + 1.53(\%C) + 0.57(\%S) + 0.14(\%N) - 0.46(\%O_2) + 0.21(\%H_2O)]}{GCV_{wet}}$$

THE DRY F-FACTOR (F_d):

Includes all components of combustion less water

$$F_d = \frac{10^6 \text{ Btu} / \text{mmBtu} [3.64(\%H) + 1.53(\%C) + 0.57(\%S) + 0.14(\%N) - 0.46(\%O_2)]}{GCV_{dry}}$$

THE CARBON F-FACTOR (F_c):

Includes only Carbon Dioxide

$$F_c = \frac{10^6 \text{ Btu} / \text{mmBtu} [0.321(\%C)]}{GCV_{dry}}$$

References for the above equations (i.e. %H, %C, %N, %S, %O₂) can be found in 40 CFR Part 60, Appendix A, Method 19.

LBS/MMBTU CALCULATIONS USING THE F-FACTOR

1. EMISSION RATE $E(\text{lb}/\text{mmbtu})$, O_2 based

$$E(\text{lb} / \text{mmbtu}) = C \times F_d \left(\frac{20.9}{20.9 - \%O_2} \right)$$

Where:

$C(\text{lb}/\text{dscf})$ = Pollutant concentration (ppm) x conversion factor.

Conversion Factors:

$$\text{NO}_x = 1.194 \times 10^{-7}$$

$$\text{SO}_2 = 1.660 \times 10^{-7}$$

$$\text{CO} = 7.274 \times 10^{-8}$$

$$\text{C}_3\text{H}_8 = 1.145 \times 10^{-7}$$

$F_d(\text{dscf}/\text{mmbtu})$ = "F" Factor for fuel type, (Ref. EPA Method 19)

$$F_d(\text{Coal}) = 9780$$

$$F_d(\text{Gas}) = 8710$$

$$F_d(\text{Oil}) = 9190$$

2. EMISSION RATE $E(\text{lb}/\text{mmbtu})$, CO_2 based

$$E(\text{lb} / \text{mmbtu}) = C \times F_c \left(\frac{100}{\%CO_2} \right)$$

Where:

$C(\text{lb}/\text{dscf})$ = Pollutant concentration (ppm) x conversion factor.

Conversion Factors:

$$\text{NO}_x = 1.194 \times 10^{-7}$$

$$\text{SO}_2 = 1.660 \times 10^{-7}$$

$$\text{CO} = 7.274 \times 10^{-8}$$

$$\text{C}_3\text{H}_8 = 1.145 \times 10^{-7}$$

$F_c(\text{dscf}/\text{mmbtu})$ = "F" Factor for fuel type, (Ref. EPA Method 19)

$$F_d(\text{Coal}) = 1800$$

$$F_d(\text{Gas}) = 1040$$

$$F_d(\text{Oil}) = 1420$$

CALCULATION OF RELATIVE ACCURACY

ARITHMETIC MEAN (OF THE DIFFERENCE , {d}, OF A DATA SET)

$$\bar{d} = \frac{1}{n} \sum_{i=1}^n d_i$$

Where n = Number of data points.

ALGEBRAIC SUM (OF THE INDIVIDUAL DIFFERENCES, {d_i})

$$\sum_{i=1}^n d_i$$

STANDARD DEVIATION, S_d

$$S_d = \sqrt{\frac{\sum_{i=1}^n d_i^2 - \frac{\left(\sum_{i=1}^n d_i\right)^2}{n}}{n-1}}$$

CONFIDENCE COEFFICIENT, CC

$$CC = t_{0.975} \frac{S_d}{\sqrt{n}}$$

For 9 tests $t_{0.975} = 2.306$

For 10 tests $t_{0.975} = 2.262$

For 11 tests $t_{0.975} = 2.228$

For 12 tests $t_{0.975} = 2.201$

RELATIVE ACCURACY, RA

$$RA = \frac{|\bar{d}| + |CC|}{RM} \times 100$$